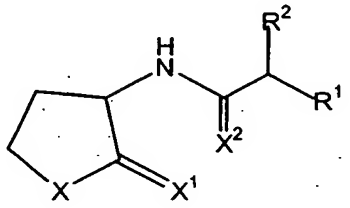
**WHAT IS CLAIMED IS:**

**1.** A compound having the structure:



(I)

wherein,

$R^1$ is a member selected from —H, —OH, and (=O);

$R^2$ is a member selected from H, reactive functional groups, alkyl groups terminally substituted with a reactive functional group and internally substituted alkyl groups terminally substituted with a reactive functional group;

X is a member selected from —O—, —S— and—NH—; and

$X^1$ and $X^2$ are members independently selected from O and S.

**2.** The compound according to claim 1, wherein $R^2$ is an internally substituted alkyl group terminally substituted with a reactive functional group.

**3.** The compound according to claim 2, wherein the alkyl group is internally substituted with a functional group that is a member selected from —OH, (=O) and combinations thereof.

**4.** The compound according to claim 1, wherein the reactive functional group is a member selected from $—OR^3$, $—NHR^4$, $—COR^5$, —SH and $—CH_2X^3$

wherein,

$—OR^3$ is a member selected from hydroxy, alkyl sulfonate and aryl sulfonate groups;

$R^4$ is a member selected from H, $C_1$-$C_6$ alkyl, $C_1$-$C_6$ substituted alkyl, aryl and substituted aryl groups;

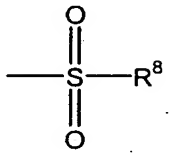
$R^5$ is a member selected from H, $X^3$ and $—OR^6$, wherein $R^6$ a member selected from alkyl, substituted alkyl, aryl, substituted aryl,

heteroaryl, substituted heteroaryl, heterocyclyl and substituted heterocyclyl groups; and

$X^3$ is a halogen.

**5.** The compound according to claim **1**, wherein the compound is a single stereoisomer.

**6.** The compound according to claim **4**, wherein $R^3$ is



(V)

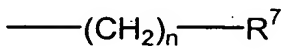
wherein,

$R^8$ is a member selected from alkyl, substituted alkyl, aryl and substituted aryl groups.

**7.** The compound according to claim **1**, wherein the alkyl and the internally substituted alkyl groups are members selected from $C_1$-$C_{20}$ saturated straight-chain, $C_1$-$C_{20}$ saturated branched-chain, $C_1$-$C_{20}$ unsaturated straight-chain, $C_1$-$C_{20}$ unsaturated branched-chain alkyl and internally substituted alkyl groups.

**8.** The compound according to claim **7**, wherein the alkyl and internally substituted alkyl groups are members selected from $C_5$-$C_{10}$ saturated straight-chain, $C_5$-$C_{10}$ saturated branched-chain, $C_5$-$C_{10}$ unsaturated straight-chain, $C_5$-$C_{10}$ unsaturated branched-chain alkyl and internally substituted alkyl groups.

**9.** A compound according to claim **1**, wherein $R^2$ has the structure:



(III)

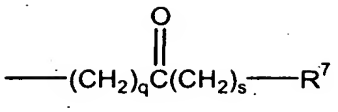
wherein,

$R^7$ a reactive functional group; and

n is a number from 1 to 20, inclusive.

**10.** The compound according to claim **9**, wherein n is a number from 2 to 9, inclusive.

**11.** A compound according to claim **1**, wherein $R^2$ has the structure:



(IV)

wherein,

$R^7$ is a reactive functional group; and

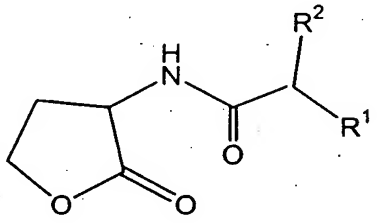
q and s are numbers independently selected from 1 to 20, inclusive.

**12.** The compound according to claim **11**, wherein s is a number from 2 to 9, inclusive.

**13.** A pharmaceutical formulation comprising a pharmaceutically acceptable carrier and a compound according to claim **1**, said reactive functional group of said compound being covalently bound to a biologically active agent.

**14.** The pharmaceutical formulation according to claim **13**, wherein said biologically active agent is a member selected from antibiotics, immune stimulators and combinations thereof.

**15.** A compound having the structure:



(II)

wherein,

$R^1$ is a member selected from H, OH, and (=O); and

$R^2$ is a member selected from H, reactive functional groups, alkyl groups terminally substituted with a reactive functional group and internally substituted alkyl groups terminally substituted with a reactive functional group, with the proviso that when $R^2$ is —OH, $R^1$ is a member selected from OH, and (=O).

**16.** The compound according to claim **15**, wherein the reactive functional group is a member selected from —$OR^3$, —$NHR^4$, —$COR^5$, SH and $CH_2X^3$ wherein,

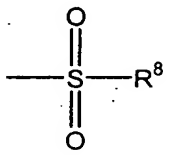
—$OR^3$ is a member selected from hydroxy, and a species such that —$OR^3$ is a leaving group;

$R^4$ is a member selected from H, $C_1$-$C_6$ alkyl, $C_1$-$C_6$ substituted alkyl, aryl and substituted aryl groups;

$R^5$ is a member selected from H, halogen and —$OR^6$, wherein $R^6$ is species such that —$OR^6$ is a leaving group; and

$X^3$ is a halogen.

**17.** The compound according to claim **16**, wherein $R^3$ is



(V)

wherein,

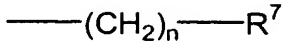
$R^8$ is a member selected from alkyl, substituted alkyl, aryl and substituted aryl groups.

**18.** The compound according to claim **16**, wherein $R^6$ is a member selected from alkyl, substituted alkyl, aryl, substituted aryl, heteroaryl, substituted heteroaryl, heterocyclyl and substituted heterocyclyl groups.

**19.** The compound according to claim **15**, wherein the alkyl and the internally substituted alkyl groups are members selected from $C_1$-$C_{20}$ saturated straight-chain, $C_1$-$C_{20}$ saturated branched-chain, $C_1$-$C_{20}$ unsaturated straight-chain, $C_1$-$C_{20}$ unsaturated branched-chain alkyl and internally substituted alkyl groups.

**20.** The compound according to claim **19**, wherein the alkyl and internally substituted alkyl groups are members selected from $C_5$-$C_{10}$ saturated straight-chain, $C_5$-$C_{10}$ saturated branched-chain, $C_5$-$C_{10}$ unsaturated straight-chain, $C_5$-$C_{10}$ unsaturated branched-chain alkyl and internally substituted alkyl groups.

**21.** A compound according to claim **15**, wherein $R^2$ has the structure:



(III)

wherein,

$R^7$ is a reactive functional group; and

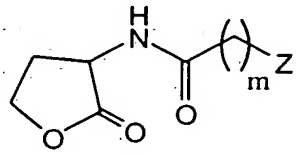
n is a number from 1 to 20, inclusive.

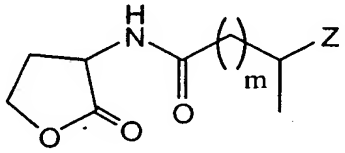
**22.** The compound according to claim **21**, wherein n is a number from 2 to 9, inclusive.

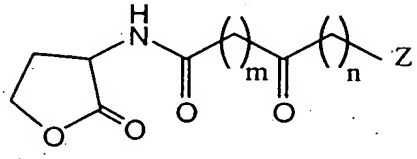
**23.** The compound according to claim **15**, wherein $R^2$ is a member selected from the group consisting of—COOH, —OH, —$NH_2$, and —SH.

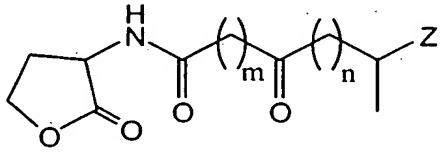
**24.** The compound according to claim **21**, wherein $R^7$ is a member selected from the group consisting of—COOH, —OH, —$NH_2$, and —SH.

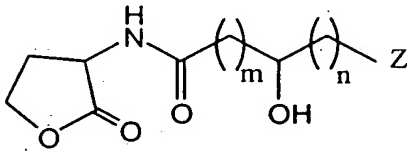
**25.** A compound having a structure that is a member selected from:

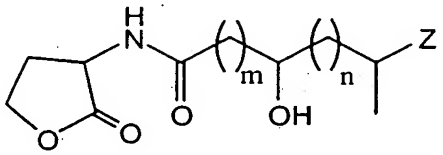


;


;


and



wherein,

m is a number selected from 1 to 20, inclusive;

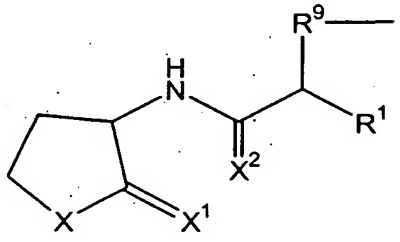
n is a number from 0 to 20, inclusive; and

Z is a reactive functional group.

**26.** The compound according to claim **25**, wherein m and n are numbers independently selected from 2 to 9, inclusive.

**27.** The compound according to claim **25**, wherein Z is a member selected from —$NH_2$, —COOH, —SH, and —OH.

**28.** An immobilized compound comprising a solid support to which is attached a molecule comprising the structure:



(VI)

wherein,

$R^1$ is a member selected from —H, —OH, and (=O);

$R^9$ is a member selected from alkyl groups and substituted alkyl groups;

X is a member selected from —O—, —S— and —NH—;

$X^1$ and $X^2$ are members independently selected from O and S.

**29.** The immobilized compound according to claim **28**, wherein the solid support is a member selected from beads, particles, membranes, substantially planar surfaces and combinations thereof.

**30.** The immobilized compound according to claim **28**, wherein the solid support comprises a member selected from silica, metal, plastic and combinations thereof

**31.** The immobilized compound according to claim **28**, wherein $R^9$ comprises a spacer moiety situated between the molecule and the solid support.

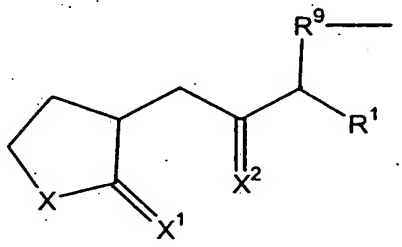
**32.** The immobilized compound according to claim **31**, wherein the spacer moiety is selected from $C_6$-$C_{30}$ alkyl groups, $C_6$-$C_{30}$ substituted alkyl groups, polyols, polyethers, polyamines, polyamino acids, polysaccharides and combinations thereof.

**33.** The immobilized compound according to claim **31**, wherein the spacer moiety comprises a cleavable moiety.

**34.** The immobilized compound according to claim **33**, wherein the cleavable moiety is cleaved by a member selected from light, heat, oxidation, reduction, enzymatic action, hydrolysis and combinations thereof.

35. The immobilized compound according to claim 34, wherein the cleavable moiety is a member selected from disulfides and esters.

36. A method for isolating a microbial receptor binding to a molecule comprising the formula:




(VI)

wherein,

$R^1$ is a member selected from —H, —OH, and (=O);

$R^9$ is a member selected from alkyl groups and substituted alkyl groups;

X is a member selected from —O—, —S— and—NH—;

$X^1$ and $X^2$ are members independently selected from O and S;

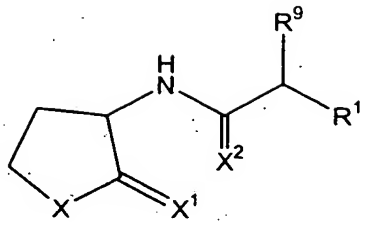
the method comprising:

contacting a microbial preparation comprising the receptor with the immobilized compound according to claim 28, thereby forming a complex between the receptor and the immobilized compound.

37. The method according to claim 36, further comprising separating the complex from components of the microbial preparation not comprising the receptor.

38. The method according to claim 37, further comprising disrupting the complex between the immobilized compound and the receptor, thereby separating the receptor from the immobilized compound.

39. An immunogenic conjugate comprising a target component comprising the structure:



(IX)

wherein,

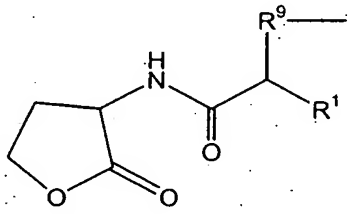
$R^1$ is a member selected from —H, —OH, and (=O);

$R^9$ is a member selected from alkyl groups and substituted alkyl groups;

X is a member selected from —O—, —S— and —NH—; and

$X^1$ and $X^2$ are members independently selected from O and S.

**40.** The immunogenic conjugate according to claim **39**, wherein the target component comprises the structure:



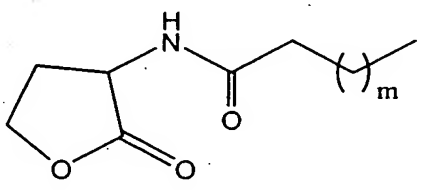
(X)

wherein,

$R^1$ is a member selected from H, OH, and (=O); and

$R^9$ is a member selected from alkyl and substituted alkyl groups.

**41.** The immunogenic conjugate according to claim **40**, wherein the target component has the structure:

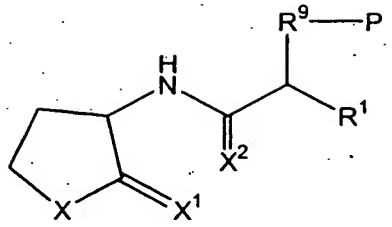


(XI)

wherein,

m is a number from 0 to 30, inclusive.

**42.** The immunogenic conjugate according to claim **39** having the structure:



wherein,

$R^1$ is a member selected from —H, —OH, and (=O);

$R^9$ is a member selected from alkyl groups and substituted alkyl groups;

X is a member selected from —O—, —S— and —NH—;

$X^1$ and $X^2$ are members independently selected from O and S; and

P is a protein carrier.

**43.** The immunogenic conjugate according to claim **42**, wherein the protein carrier has a molecular weight of greater than or equal to 5000 daltons.

**44.** The immunogenic conjugate according to claim **43**, wherein the protein carrier is a member selected from albumin and hemocyanin.

**45.** The immunogenic conjugate according to claim **39**, wherein $R^9$ comprises a spacer moiety situated between the target component and the protein carrier.

**46.** The immunogenic conjugate according to claim **45**, wherein the spacer moiety is selected from $C_6$-$C_{30}$ alkyl groups, $C_6$-$C_{30}$ substituted alkyl groups, polyols, polyethers, polyamines, polyamino acids, polysaccharides and combinations thereof.

**47.** The immunogenic conjugate according to claim **45**, wherein the spacer moiety comprises a cleavable moiety.

**48.** The immunogenic conjugate according to claim **47**, wherein the cleavable moiety is cleaved by a member selected from light, heat, oxidation, reduction, enzymatic action, hydrolysis and combinations thereof.

**49.** The immunogenic conjugate according to claim **48**, wherein the cleavable moiety is a member selected from disulfides and esters.

**50.** A pharmaceutical formulation comprising the immunogenic conjugate according to claim **39** and a pharmaceutically acceptable carrier.

**51.** The pharmaceutical formulation according to claim **50**, wherein the pharmaceutical formulation is a vaccine effective for preventing or reducing microbial infection in a subject to whom the vaccine is administered.

**52.** An antibody that binds specifically to the immunogenic conjugate according to claim **39**.

**53.** An isolated nucleic acid encoding the antibody according to claim **52**.

**54.** The isolated nucleic acid according to claim **53**, further comprising a promoter operably linked to the nucleic acid sequence encoding the antibody.

**55.** An expression vector comprising the nucleic acid according to claim **53**.

**56.** A host cell comprising the expression vector according to claim **55**.

**57.** The antibody according to claim **52**, further comprising a member selected from detectable labels, biologically active agents and combinations thereof covalently attached to the antibody.

**58.** The antibody according to claim **57**, wherein the detectable label is a member selected from the group consisting of radioactive isotopes, fluorescent agents, fluorescent agent precursors, chromophores, enzymes and combinations thereof.

**59.** The antibody according to claim **58**, wherein the biologically active agent is a member selected from antibiotics, immune stimulators and combinations thereof.

**60.** A pharmaceutical formulation comprising the antibody according to claim **52** and a pharmaceutically acceptable carrier.

**61.** A method for treating or preventing a disease in a subject caused by a microorganism, the method comprising administering to the subject an amount of the antibody according to claim **52** effective to reduce or prevent the disease state.

**62.** A method for treating or preventing a disease in a subject caused by a microorganism, the method comprising administering to the subject an amount of the vaccine according to claim **51** effective to reduce or prevent the disease state.

**63.** A method for treating or preventing a disease in a subject caused by a microorganism, the method comprising administering to the subject an amount of the immunogenic conjugate according to claim **39** effective to reduce or prevent the disease state.

**64.** The method according to claim **61**, wherein the disease is a microbial infection.

**65.** The method according to claim **62**, wherein said microbial infection accompanies cystic fibrosis.

**66.** The method according to claim **74**, wherein said microbial infection has a causative agent comprising P. *aeruginosa*.

**67.** A method for preventing or disrupting the formation of a biofilm, the method comprising contacting a microbial culture capable of forming a biofilm with an antibody according to claim **52**.

**68.** The method according to claim **67**, wherein said biofilm comprises P. *aeruginosa*.

**69.** The method according to claim **67**, wherein said biofilm is associated with an implanted medical device.

**70.** The method according to claim **67**, wherein said biofilm is associated with an organ *in vivo*.

**71.** A method for controlling autoinducer responsive gene expression in a microorganism, the method comprising contacting the microorganism with an antibody according to claim **52** effective to control said gene expression.

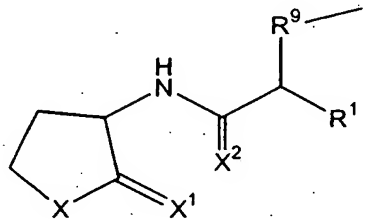
**72.** A method for controlling autoinducer responsive gene expression in a microorganism, the method comprising contacting the microorganism with an antibody according to claim **51** effective to control said gene expression.

**73.** A method for controlling autoinducer responsive gene expression in a microorganism, the method comprising contacting the microorganism with an antibody according to claim **39** effective to control said gene expression.

**74.** The method according to claim **71**, wherein the microorganism is bacteria.

**75.** The method according to claim **74**, wherein said bacteria is P. *aeruginosa*.

**76.** A library of compounds comprising a structure according to Formula I:




(IX)

wherein,

$R^1$ is a member selected from —H, —OH, and (=O);

$R^9$ is a member selected from alkyl groups and substituted alkyl groups;

X is a member selected from —O—, —S— and —NH—;

$X^1$ and $X^2$ are members independently selected from O and S, the library comprising a first compound according to Formula I and a second compound according to Formula I, wherein the first compound differs from the second compound in the identity of a member selected from $R^1$, $R^9$, X, $X^1$, X and combinations thereof.

77. The library according to claim 76, comprising at least 10 compounds.

78. The library according to claim 77, comprising at least 100 compounds.

79. The library according to claim 78 comprising at least 1000 compounds.

80. The library according to claim 79 comprising at least 100,000 compounds.

81. A method of detecting an autoinducer in a sample, the method comprising the steps of:

(a) contacting the sample with an antibody that specifically binds to the autoinducer; and

(b) determining whether the sample contains the autoinducer, thereby detecting said autoinducer.

82. The method of claim 81, wherein the antibody is a monoclonal antibody.

83. The method of claim 81, wherein the antibody is a polyclonal antibody.

84. The method of claim 81, wherein the step of determining whether the sample contains an autoinducer comprises detecting the antibody in an assay selected from the group consisting of an ELISA assay, a western blot, an immunohistochemical assay, an immunofluorescence assay, and a real time imaging assay.

85. The method of claim 81, wherein the step of determining whether the sample contains an autoinducer further comprises quantitating the amount of autoinducer in the sample.

86. The method of claim 81, wherein the antibody is bound to a solid substrate.

**87.** The method of claim **81**, wherein the sample is selected from the group consisting of a cultured cell, and a patient sample.

**88.** The method of claim **87**, wherein the patient sample is a blood sample.

**89.** The method of claim **87**, wherein the patient sample is from a human patient.

**90.** The method of claim **81**, wherein the antibody is covalently linked to a detectable moiety.

**91.** The method of claim **90**, wherein the antibody is covalently linked to a member selected from a biotin moiety, a radioactive moiety, an enzyme moiety and combinations thereof.

**92.** A method of monitoring the amount of autoinducer in a patient treated with an agent that inhibits the growth of an organism producing the autoinducer, the method comprising:

(a) providing a sample from the patient treated with the growth inhibiting agent;

(b) contacting the sample with an antibody that specifically binds to an autoinducer; and

(c) determining the amount of autoinducer in the patient sample by detecting the antibody and comparing the amount of antibody detected in the patient sample to a standard curve, thereby monitoring the amount of autoinducer in the patient.

**93.** The method of claim **92**, further comprising the step of adjusting the dose of the growth inhibiting agent administered to the patient.

**94.** The method of claim **92**, wherein the sample is a blood sample.

**95.** The method according to claim **94**, wherein said blood sample is derived from a patient having cystic fibrosis and an infection comprising P. *aeruginosa*.

96. The method of claim 92, wherein the antibody is a monoclonal antibody.

97. The method according to claim 92, wherein said antibody is a polyclonal antibody.

98. The method of claim 92, wherein the antibody is covalently linked to a detectable moiety.

99. The method of claim 98, wherein the antibody is covalently linked to a member selected from a biotin moiety, a radioactive moiety, an enzyme moiety and combinations thereof.

100. The method of claim 92, wherein the antibody is bound to a solid substrate.

101. A method of isolating an autoinducer, the method comprising the steps of:

(a) providing a sample comprising the autoinducer;

(b) contacting the sample with an antibody that specifically binds to the autoinducer, thereby forming an autoinducer-antibody complex; and

(c) isolating the autoinducer-antibody complex by isolating the antibody.

102. The method of claim 101, wherein the antibody is a monoclonal antibody.

103. The method of claim 101, wherein the antibody is covalently linked to member selected from a biotin moiety, a radioactive moiety, an enzyme moiety and combinations thereof.

104. The method of claim 101, wherein the antibody is bound to a solid substrate.

105. A method of detecting an antibody that specifically binds to an autoinducer, the method comprising the steps of:

(a) providing a sample;

(b) contacting the sample with a peptide that specifically binds to the antibody; and

(c) detecting the antibody.

**106.** The method of claim **105**, wherein the step of detecting the antibody comprises an ELISA assay.

**107.** The method of claim **105**, wherein the peptide is bound to a solid substrate.

**108.** A kit for detecting an autoinducer in a sample, the kit comprising:

(a) an antibody that binds specifically to the autoinducer;

(b) directions for using the antibody to detect the autoinducer.